

# 'PAIN NEUROPHYSIOLOGY EDUCATION' AS PART OF A PAIN MANAGEMENT SERVICE DECREASES FEAR AVOIDANCE AND IMPROVES PATIENT'S UNDERSTANDING OF THE NEUROPHYSIOLOGY OF CHRONIC PAIN AT FOUR MONTHS FOLLOW UP.

## AUTHORS:

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## Abstract

The aim of this service evaluation was to investigate whether the *Pain Neurophysiology Education (PNE)* service provided at a pain clinic in a northern hospital in the UK increases patients understanding of the neurophysiology of chronic pain and reduces fear avoidance beliefs and pain catastrophising. Data was collected using the Neurophysiology of Pain Questionnaire (NPPQ), the Tampa Scale of Kinesiophobia (TSK) and the Pain Catastrophising Scale (PCS). Patient data (n=18) was collected pre-intervention, post-intervention and at the four month follow up point. The results demonstrated a mean improvement of 22.5% from pre to post intervention on the NPPQ and a maintained improvement of 14% from post to follow up. This result was shown to be statistically significant. There was a mean improvement of 4 points on the TSK which was also shown to be statistically significant. There was a small, but non statistically significant, improvement of 2 points on the PCS. This service evaluation provides some basic evidence that PNE delivered by our physiotherapy team can improve and maintain patients understanding of their pain and start to address some of their negative beliefs associated with complex persistent pain.

## Introduction

Patient education has an important role in chronic pain management. Pain Neurophysiology Education PNE is an educational approach to pain management (Butler & Moseley, 2003). It attempts to increase the patients understanding of chronic pain in a manner which will reduce the threat value of that pain. There is a growing body of evidence that PNE is useful for improving a range of bio psychosocial outcome measures including pain, function, and catastrophising (Clark et al, 2011; Louw et al, 2011; Louw et al. 2012).

Of particular note is the improvements seen with PNE in the socioeconomic outcome work status. Individuals receiving

PNE alongside a pain management programme are four times more likely to have an improved work status at six months and twice as likely to have an improved work status at 12 months compared to those receiving pain management only (Clarke et al. 2011). With the introduction of clinical commissioning of 'any qualified provider' into the current UK health care climate the need to evidence the effectiveness of services is more important than ever. The evidence discussed above provides evidence for the intervention itself but it does not provide evidence that individual health care teams can translate these research findings into improved patient outcomes. Audit of service outcomes is therefore essential.

PNE was recently introduced into the pain management service at a northern Hospital. The aim was to enhance patient's understanding of their pain, reduce inappropriate and unhelpful attitudes and therefore facilitate rehabilitation. Previous work has demonstrated high levels of patient satisfaction with this intervention, and increased patient knowledge of pain biology in the short term (Robinson and King, 2012). However, increased knowledge of pain biology in itself is not a clinical outcome and it provides little indication of any change in the patient's attitudes towards their pain condition or that the threat value of the pain has been reduced. Both fear avoidance beliefs and pain catastrophising are constructs which tap into the threat value of pain perceived by patient's.

Thus, the aim of this service evaluation was to investigate the short-to-moderate term effects of PNE on knowledge of the neurophysiology of chronic pain, fear avoidance beliefs, and pain catastrophising.

## Method

### Overview

Participants in this service evaluation were patients who were referred or self-referred to the PNE session from the chronic pain service. Patients were seen in groups on a first come first served basis. Each group consisted of four to ten patients who received a two hour PNE session. Outcomes were taken pre-treatment, post-treatment and at a four month follow up point.

### Pain Neurophysiology Education

In each group a set curriculum of up to date evidence-based information on the neurophysiology and biopsychosocial models of pain was delivered based around the Explain Pain manual developed by Lorimer Moseley and David Butler (Butler & Moseley, 2003). The sessions were delivered in an informal manner using various visual aids (e.g. posters, free hand drawings, and hand-outs). Patients were encouraged to participate in the education by engaging in conversation with the clinician and asking questions. The aims of the sessions were to increase the patient's understanding of the neurophysiology of chronic pain pathways and the influences of psychosocial factors on that neurobiology that contribute to prolonged intractable pain.

Concepts of peripheral and central sensitisation were discussed. The patients were also introduced to the pain Neuromatrix, cortical representation of pain and the psychosocial influences on these biological processes as outlined in the Explain Pain Manual (Butler and Mosesly, 2003). Finally treatment and management strategies concluded the 2 hour session. For further detail see Robinson and King (2011).

### Outcome measures

Participants completed three questionnaires; the Neurophysiology of Pain Questionnaire (NPPQ), The Tampa Scale of Kinesiophobia (TSK), and the Pain Catastrophising Scale (PCS). All participants were posted out the questionnaires at the four month follow up point and asked to complete and return them via a pre-paid envelope. Due to the fact that patients attended different PNE sessions the timing of the four month follow up was not uniform and actually ranged from three and eight months.

The NPPQ contains 19 Yes/No items and measures patients' understanding/knowledge of pain neurophysiology. It has been validated for both clinician and patient use. (Moseley, 2003). The results of the NPPQ are presented as a percentage. The NPPQ was measured pre-intervention, post-intervention and at four month follow-up.

The TSK is a validated measure of an individual's fear of movement defined as an "irrational and debilitating fear of physical movement resulting from a feeling of vulnerability to painful injury or re-injury" (Kori et al. 1990). The questionnaire contains 17 likert-scale items ranging from 1 (strongly disagree) to 4 (strongly agree). The total score ranges from 17-68 with higher scores representing higher levels of fear of movement. The TSK was measured pre-intervention and at the four month follow-up point. The PCS is a validated measure of pain catastrophising defined as "an exaggerated negative orientation toward noxious stimuli" (Sullivan et al. 1995). The questionnaire contains 13 likert-scale items ranging from 0 (not at all) to 4 (all the time). The total score ranges from 0-52 with a higher score indicative of higher levels of catastrophising. The PCS was measured pre-intervention and at the four month follow-up point. The TSK and the PCS were measured at pre-intervention and at four month follow-up, there was no post-intervention measurement point for these outcomes as routine clinical practice for our service was only to undertake the pain quiz immediately post-intervention as a form of patient feedback.

Change scores for pre-treatment to post treatment and four month follow up were assessed using simple paired t-tests, as the data was normally distributed.

### Results

Seventy three patients attended the PNE education session over a twelve month period. All 73 patients were posted out the questionnaires at the four month follow up point. Eighteen patients (24%) responded to follow up, (8 male,

10 female) with an age range of 23-65years. The data for these ten participants are presented here.

### NPPQ

Eighteen participants responded to follow up. Eight were male and ten were female. All eighteen fully completed the NPPQ. The mean pre intervention score was 41.8% (SD 19.48). The mean post intervention score was 64.3% (SD 13.45). This represents an improvement of 22.5% (17.0 to 28.0%) ( $p < 0.01$ ) (Mean difference (95% CI) p-value). The mean NPPQ score at four month follow-up was 55.8% (SD 22.5). This represents a mean improvement of 14% (7.7 to 20.4) ( $p < 0.01$ ) from pre intervention but a 8.5% reduction (-0.1 to 17.1) ( $p = 0.05$ ) from post intervention (Figure 1).

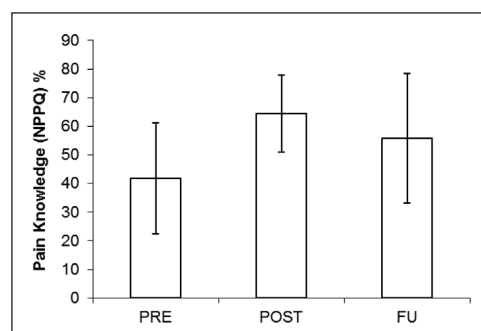
### TSK

Sixteen participants fully completed the TSK at four months follow up. Six were male and ten were female. The mean pre intervention TSK score was 38.7/68 (SD 6.6). The mean TSK score at follow up was 34.8/68 (SD 8.6). This represents a mean improvement of 3.9 (0.4 to 7.5) ( $p = 0.03$ ) (Mean difference (95% CI) p-value) (Figure 2).

### PCS

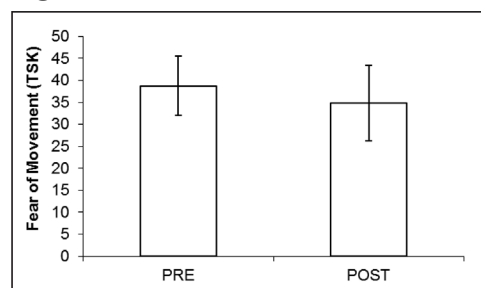
Eighteen participants fully completed the PCS at four months follow up. The mean pre intervention score was 25.5/52 (SD 11.18). The mean score at follow up was 23.5/52 (SD 13.6). This represents a mean improvement of 2 (-1.1 to 5.1) ( $p = 0.19$ ) (Mean difference (95% CI) p-value) (Figure 3).

**Figure 1: Pain Knowledge outcome**



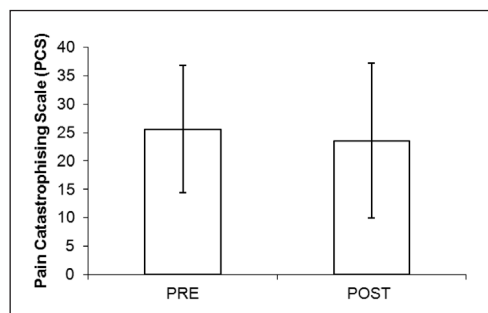
Legend: Pain Knowledge pre intervention, post intervention and at follow up. Data are presented as mean ( $\pm 1SD$ ). NPPQ = Neurophysiology of Pain Questionnaire.

**Figure 2: Fear of Movement outcome**



Legend: Fear of Movement pre intervention and four months post intervention. Data are presented as mean ( $\pm 1SD$ ). TSK = Tampa Scale of Kinesiophobia.

**Figure 3:** Pain Catastrophising outcome



*Legend: Pain Catastrophising pre intervention and four months post intervention. Data are presented as mean ( $\pm 1SD$ ). PCS = Pain Catastrophising Scale.*

## Discussion

This service evaluation found that chronic pain patients significantly increased their understanding about the biology of chronic pain following a PNE session and this improvement was maintained at the 4 month follow up point. There was a significant improvement in fear of movement but not for pain catastrophising at the four month follow up point.

The magnitude of the improvement in pain knowledge (~22% and 14% at follow up) found in this service evaluation was in keeping with previous studies of PNE (Moseley, 2003). This shows that patients can understand complex pain information when it is presented in this manner and reduces concerns some clinicians may have that patients cannot understand such information (Moseley, 2003). Furthermore this service evaluation demonstrates retention of the knowledge at 4 months suggesting that deep rather than superficial learning occurred. However pain knowledge had reduced compared to immediately post the intervention and it is possible that over time the knowledge could have continued to decline. Thus it may be warranted to give patients a “booster education” session around the four-month mark to bolster the initial gains in knowledge from the first session.

A significant problem with chronic pain patients is fear of movement due to their belief that pain equates to tissue damage. It has been proposed that this fear is just as debilitating as the pain itself (Waddell et al. 1993). This negative and inappropriate assumption can result in decreased function and quality of life (Swinkels-Meewisse et al. 2006; Picavet et al. 2002). This service evaluation found that fear of movement is reduced four months after PNE and this change was statistically significant. No literature exists which has previously investigated the effects of PNE on fear of movement as measured by the TSK though our findings are in line with previous literature which has shown that PNE can reduce patients attitudes that pain is indicative of harm (Moseley et al. 2004).

Catastrophising is predictive of pain disability and service use in chronic pain patients (Sullivan et al. 2001). Similar to fear of movement, catastrophising also improved following the intervention. However, the improvement was not statistically

significant, and the size of the change of was of questionable clinical relevance (2 points). This finding is contrary to the literature which has shown that Pain Neurophysiology Education can significantly improve catastrophising by an average of 6 points (Moseley et al. 2004). It is unclear why this result in our service evaluation differed from the literature, but it is likely due to methodological differences. One key difference is that the education in Moseley et al. (2004) was delivered on a one to one basis rather than a group delivery system.

It is hoped better informed patients who understand that chronic pain does not equate to tissue damage will have the confidence to increase their function. This in turn could lead to better quality of life and reduced service use. Informing the patient as to the nature of chronic pain undoubtedly takes time, in the long term however, along with exercise and pain medication, it may be one of the most appropriate and efficient interventions for patients. This service evaluation shows that PNE sessions have been worth incorporating into our pain management services. In future research we plan to qualitatively investigate patient’s attitudes and feeling towards the PNE sessions.

It is important to remember that the improvements seen with this intervention are in addition to the improvements that would have already been achieved by receiving a comprehensive pain management service. Baseline values were measured after these other pain interventions had been received as part of the patient’s usual care, rather than a true baseline where no interventions whatsoever had been received. This may partially explain the relatively small improvement in catastrophising. This makes the improvements seen here particularly interesting considering the intransigent nature of chronic pain to intervention and the results should be viewed within this context. When this is combined with the pragmatic elements of the intervention, such as its low costs and brevity, it highlights the attractiveness of this intervention within pain management.

## Limitations

As this study was a simple service evaluation it cannot be categorically stated that the improvement in knowledge was due to the education. There was no control group or random allocation to such a group, thus any improvement could have been due to time, natural recovery, regression to the mean, or non-specific therapeutic effects such as the placebo effect. Only 24% of patients responded to the follow up questionnaires thus they may not be a true representation of the patients attending the clinic. The reason for the low response rate is unknown.

The sample size for this study was small ( $n=18$ ) increasing the risk of a type II statistical error. A post hoc power calculation assuming an alpha level of 0.05 and a power of 80% suggests that a sample size of 84 participants (42 in each group) would

be needed to appropriately power an RCT to detect a 5 point difference in fear of movement.

### Future work

PNE has only recently been introduced as an intervention at our Pain Clinic and the service is still being developed. A qualitative study is underway assessing the intervention from the patient's perspective in addition to identifying possible ways in which the service can be enhanced. Once this has been completed and the service adapted accordingly, a robust mixed method RCT should be carried out to assess the additional benefits (on a range of clinical and economic outcome measures) of PNE when combined with usual care pain management in comparison to usual care pain management alone

### Conclusions

This service evaluation has shown that PNE can increase patients understanding of their pain and that this understanding can be maintained for months after the intervention. There was evidence of a statistically significant reduction in fear of movement as well as small improvements in catastrophising, though this improvement in catastrophising was not statistically significant. Further investigation and development of this promising intervention is warranted.

## References

- Butler DS, Moseley GL. (2003) *Explain Pain*. Adelaide: Noigroup Publications.
- Clarke CL, Ryan CG, Martin DJ. (2011) Pain Neurophysiology Education for the Management of Individuals with Chronic Low Back Pain: A Systematic Review and Meta-analysis. *Manual Therapy*; 16: 544-549.
- Kori SH, Miller JA, Todd DD. (1990) Kinesiophobia: a new view of chronic pain behaviour. *Pain Management*, 35-43.
- Louw A, Diener I, Butler DS, Puentedura EJ. (2011) The effect of Neuroscience Education on Pain, Disability, Anxiety, and Stress in Chronic Musculoskeletal Pain. *Archives of Physical Medicine and Rehabilitation*; 92: 2041-2056.
- Louw A, Puentedura EJ, Mintken P. (2012) Use of an abbreviated neuroscience education approach in the treatment of chronic low back pain. *Physiotherapy Theory and Practice*; 28: 50-62.
- Moseley L. (2003) Unravelling the Barriers to Reconceptualisation of the Problem in Chronic Pain: The Actual and Perceived Ability of Patients and Health Professionals to Understand the Neurophysiology. *The Journal of Pain*; 4: 184-9.
- Moseley LG, Nicholas MK, Hodges PW. (2004) A Randomised Controlled Trial of Intensive Neurophysiology Education in Chronic Low Back Pain. *Clinical Journal of Pain*; 20: 324-30.

Picavet HSJ, Vlaeyen JWS, Schouten JSAG. (2002) Pain catastrophising and kinesiophobia: predictors of chronic low back pain. *American Journal of Epidemiology*; 156: 1028-1034.

Robinson V, King R. (2011) Explain pain as part of a pain management service improves patients' understanding of the neurophysiology of chronic pain. *Journal of the Physiotherapy Pain Association*; 32:27-30

Sullivan MJL, Bishop SR, Pivik J. (1995) The pain catastrophising scale: development and validation. *Psychological Assessment*; 7: 524-32.

Sullivan MJL, Thorn B, Hythornthwaite JA, Keefe F, Martin M, Bradley LA, Lefebvre JC. (2001) Theoretical perspectives on the relation between catastrophising and pain. *The Clinical Journal of Pain*; 17:52-64.

Swinkels-Meewisse ISE, Roelefs J, Schouten EGW, Verbeek A, Oosendorp RAB, Vlaeyen J. (2006) Fear of movement/ (re) injury predicting chronic disabling low back pain: a prospective inception cohort study. *Spine*; 31: 658-664.

Waddell G, Newton M, Henderson I, Somerville D, Main CJ. (1993) A fear-avoidance beliefs questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain*; 52: 157-168.

